

Analytical Sciences

An integrated approach to measurement needs

Solutions to analytical problems tailored to specific needs are available from the

- Analytical Sciences Division
- Forensic Science Center
- Environmental Analytical Sciences Laboratory
- Radiation Analytical Sciences Laboratory.

Analytical Sciences Division

The Analytical Sciences Division (ASD) of the Chemistry and Materials Science Directorate provides a broad spectrum of analytical chem-

istry support services to scientific and engineering programs. ASD technical staff members solve problems ranging from those requiring routine or standard analyses to those requiring development of new methods or techniques. Analytical capabilities include:

- Elemental and compositional analyses of solid, liquid, and gaseous samples
- Speciation and oxidation state determination of elements in solution
- Identification of contamination on material surfaces
- Determination of isotopic ratios and abundances
- Qualitative and quantitative analysis
- Incident analysis
- Identification of toxic metals or organic contaminants in a variety of matrices.

Various techniques are available to analyze samples for inorganic and organic constituents. An x-ray fluorescence spectrometer or a dc arc emission spectrograph provide bulk or semi-quantitative determination of elemental composition for most of the periodic table,

while inductively coupled plasma, optical emission spectrometry can detect elements at sub-part-per-million levels. When greater sensitivity or isotopic abundance information is needed, inductively coupled plasma mass spectrometry is used. If high-precision isotope ratios are required, thermal ionization mass spectrometry is available.

Gas chromatography-mass spectrometry is used to determine the identity of pure organic compounds or to separate and identify the individual constituents in complex organic mixtures. Infrared microscopy can be used for analysis of small particles (20 to 100 μm in diameter) and fibers, as well as surface analysis of thin films.

Other analytical techniques include optical absorption or emission spectroscopy, high-performance liquid chromatography, ion chromatography, combustion (CHNOS) analysis, and nuclear magnetic resonance spectrometry of both liquid and solid samples. Classical solution and electrochemical analytical methods are also available.

Forensic Science Center

The Forensic Science Center (FSC), associated with the Nonproliferation, Arms Control, and International Security Directorate at LLNL, complements the capabilities of the Analytical Sciences Division. The Center specializes in:

- Failure analysis
- Analysis of suspect illicit drugs and explosives.
- Analyses related to national security
- Development of field detection kits and field-portable equipment for on-site analyses of chemical species
- Instrument development in support of nonproliferation efforts
- Methods development for ultratrace analysis.

The FSC has also worked closely with law-enforcement agencies in the San Francisco Bay Area on a variety of problems.

APPLICATIONS

- Identification of minute quantities of materials related to nonproliferation, counterterrorism, law enforcement, antinarcotics, and environmental protection activities
- Instrument development in support of nonproliferation efforts
- Methods development for ultratrace analysis
- Development of field detection kits and field-portable equipment for on-site analyses of chemical species
- Hazardous/radioactive waste analysis
- Trace analysis in complex mixtures
- Analysis of biological materials

Other activities include designing and evaluating mass spectrometer systems (single and triple quadrupole, magnetic sector, ion trap, ion cyclotron resonance, and time-of-flight) as well as hyphenated systems, such as gas or liquid chromatography–mass spectrometry and capillary electrophoresis–mass spectrometry for specific applications. Examples of these applications are the determination of nitrogen-containing compounds (explosives, drugs of abuse) and analysis of biological materials. Available forensic biology methods are DNA purification, hybridization, visualization, and amplification (using the polymerase chain reaction). In addition, the FSC is involved in designing and constructing field-portable mass spectrometers.

To date, the substances we have analyzed for clients include high explosives, compounds related to chemical weapons, genetic material, narcotics, and radionuclear species.

Environmental Analytical Sciences Laboratory

A facility that addresses environmental concerns, the Environmental Analytical Sciences (EAS) Laboratory is contained within the Analytical Sciences Division. EAS is certified by the State of California for the analysis of hazardous waste. Services offered by EAS range from providing trained sampling technicians for sample collection to performing analysis in accordance with strict EPA protocols.

Radiation Analytical Sciences Laboratory

A second laboratory that addresses environmental concerns is the Radiation Analytical Sciences (RAS) Laboratory, which is closely related to the Environmental Analytical Sciences Laboratory. RAS is associated with LLNL's Nuclear Chemistry Division. Also a State of California certified laboratory, RAS specializes

in the identification and quantification of radioactive components that may exist in waste samples. RAS also has a major effort focusing on extremely low-level detection of radionuclides in support of environmental monitoring activities.

Availability: Available now. LLNL seeks to collaborate with industry to bring state-of-the-art analytical capabilities to bear on problems of mutual interest. An essential aspect of our efforts is the application of an integrated approach to solve complex analytical problems. Our technical staff is committed to providing high-quality results on schedule with optimal cost management.

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